

Temporal Dynamics and Geographic Dissemination of Infectious Diseases

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Each year we can see news about infection outbreaks somewhere in the world, either of diseases known since ancient times or new diseases like the Ebola outbreak still ongoing in West Africa. In this talk, we show some models based on differential equations which can help to understand the temporal and spatial evolution of these infections. We begin with the simplest models of direct contact infections such as influenza and Ebola and continue with infections transmitted by vectors such as dengue fever and West Nile infection. Next, we continue with two different models of geographic dispersion of these diseases. The first is based on classical diffusion and the second on diffusion on a graph. These two diffusions model different characteristics of behavior of the dissemination of infections at different spatial scales. Some infections clearly propagate as a continuous front through the geographical environment, this is the case of rabies and the plague that devastated Europe in the fourteenth century. Others however seem to follow routes such as roads or rivers, for example, the 2009 flu outbreak and the latest Ebola outbreak that began in Guinea and dispersed around the world.